REMARKS

Claims 13-18, 21, 22, and 24-28 are pending in the present application. Claims 19, 20 and 23 are herein canceled. Claims 13-18, 21, 22 and 24-28 are herein amended. No new matter has been presented.

In Claim 13, the language "under reduced pressure" (line 4) is supported by the specification at paragraph [0023], line 14 and by the JP priority document at paragraph [0030], lines 3 and 4.

In Claim 13, the language "2 m/s or higher" (line 7) is supported by "200 cm/s or above" in the specification at paragraph [0019], line 6 and by the language "in a range of 200 to ··· cm/s" in the JP priority document at paragraph [0007], lines 4-5.

In Claim 13, the language "the elemental ratio of carbon in the hydrocarbon-containing material gas with respect to oxygen in the oxygen-containing gas at the time of burning the hydrocarbon-containing material gas is 1.08 or higher but not higher than 1.56" (lines 8-10) is supported by the specification at paragraph [0023], lines 4-7 and by the JP priority document at paragraph [0015], lines 2-4.

In Claim 14, "2 m/s" (line 4) is supported by "200 cm/s or above" in the specification at paragraph [0019], line 6 and by the language "in a range of 200 to ··· cm/s" in the JP priority document at paragraph [0007], lines 4-5.

In Claims 15 and 16, the numeric values 30, 1000 have been recited with the unit (m·torr/s).

Claim 17 has been amended to include the limitation of Claim 19, and Claim 19 has been cancelled.

Claim 18 has been amended to include the limitation of Claim 20, and Claim 20 has been cancelled.

In connection with cancellation of Claims 19 and 20, Claim 21 has been amended to be dependent from Claim 17, and Claim 22 has been amended to be dependent from Claim 18.

In connection with cancellation of Claims 23, Claims 24-28 have been amended to be dependent from Claim 13.

Improper IDS

The Examiner notes that Applicants have submitted a document with 4 pages reduced and reproduced onto one. The Examiner notes that this fails to comply with 37 C.F.R. §1.98(a)(2), which requires a legible copy of each foreign patent be submitted. The Examiner has crossed out the reference considered to be illegible.

Applicants note that the reference cited as illegible by the Examiner, JP 6-507879, was cited by Applicants as corresponding with US 5,273,729. Because US 5,273,729 was properly considered (and in fact, cited against the present claims), Applicants do not resubmit JP 6-507879.

Drawings

The Examiner asserts that new corrected drawings in compliance with 37 CFR §1.121(d) are required in this application because it is not entirely clear what Applicants are showing is new.

Applicants submit that the drawings do not illustrate prior art apparatuses.

Applicants submit that the fullerene producing equipment shown in FIG. 1 of the present application resembles equipment shown in FIG. 2 of Alford et al. because parts of a basic device of the equipment of FIG. 1 of the present application were purchased from a company associated with the applicant of Alford et al. However, the equipment of FIG. 1 of the present application is different from that of Alford et al. in basic structure, and is not conventional equipment. In the equipment of Alford et al., a fullerene reactor has a normal constitution in which a burner is located at a lower position and a discharge port is located at an upper position. In the equipment of FIG. 1 of the present application, in contrast, the fullerene reactor has an inverted constitution in which the burner is located at an upper position and the discharge port is located at a lower position. In the reactor of FIG. 1 of the present application, due to the above constitution, soot generated at the time of burning hydrocarbons collects at a discharge port located below. Thus, the reactor of FIG. 1 of the present application has an advantage that it needs less frequent cleaning and further an advantage of improved soot recovery rate.

The fullerene producing equipment of FIG. 2 of the present application is different from the producing equipment of Alford et al. in that the fullerene reactor of FIG. 2 has inverted constitution and the fullerene producing equipment of FIG. 2 has the cyclone-type gas cooling unit 31 for cooling gas.

Claim Rejections - 35 U.S.C. §112, second paragraph

Claims 13 and 15-16 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner asserts that Applicants recite a discharge rate of a gas, but claim this in terms of a velocity.

Applicants herein change "discharge rate" to "discharge velocity".

With respect to Claims 15-16, the Examiner asserts that the numbers recited are not dimensionless. Applicants herein amend claims 15 and 16 to recite, "wherein (V·P) is in a range of 30 to 1000 m ·torr/s".

Claim Rejections - 35 U.S.C. §102(a)

Claims 13-16 are rejected under 35 U.S.C. §102(a) as being anticipated by Yoshikawa et al., *PAH and Fullerene formation from low pressure combustion under various flame condition*, 41st Symposium on Combustion, December 3-5, 2003. The additional authors of Yoshikawa and the PCT filing date serve as the basis for application of Yoshikawa under §102(a).

Applicants submit that the substance of these rejections over Yoshikawa et al. does not need to be addressed. Yoshikawa et al. was published as early as December 3, 2003. The International filing date, and therefore the effective U.S. filing date of the present invention was June 10, 2004. However, the present application claims priority to Japanese Application 2003-165384, filed on June 10, 2003. Therefore, Applicants submit that because the Japanese priority document supports the present specification and especially the amended claims, Applicants can rely on its priority date if Applicants submit a verified English translation of the document to the U.S. Patent Office.

Applicants submit herewith a verified English translation of the JP priority document, which perfects Applicants' priority. Thereafter, Yoshikawa et al. is no longer a valid reference under 35 U.S.C. §102(a) to the extent that the priority document supports the claimed invention.

The JP priority document supports Claims 13 and 14 of the present application, but not the (P·V) values in Claims 15 and 16. Yoshikawa et al. recites values which yield outputs equivalent to the (P·V) values recited in Claims 15 and 16 of the present application. Yoshikawa et al., however, does not describe that fullerene yield is increased by controlling "the elemental ratio of carbon in the hydrocarbon-containing material gas with respect to oxygen in the oxygen-containing gas at the time of burning the hydrocarbon-containing material gas to 1.08 or higher but not higher than 1.56," which is disclosed in both the JP priority document and the present specification.

Claims 13-16 are rejected under 35 U.S.C. §102(a) as being anticipated by JP 2003-192318 to Hiroaki (sic: Takehara) et al. The PCT filing date and the additional inventor on the Hiroaki (sic: Takehara) reference serve as the basis for application for Hiroaki (sic: Takehara) under §102(a).

With respect to Claim 13-14, Hiroaki (sic: Takehara) discloses a method for making fullerenes with the claimed velocity. As to Claims 15-16, the Examiner asserts that Hiroaki (sic: Takehara) teaches pressures to meet the claimed limitation.

Applicants note that the cited JP 2003-192318 was published on July 9, 2003. Therefore, JP 2003-192318 would be a proper reference under 35 U.S.C. §102(a). However, the present application claims priority to Japanese Application 2003-165384, filed on June 10, 2003.

Therefore Applicants submit herewith a verified English translation of the JP priority document, which perfects Applicants' priority. Thereafter, Hiroaki (sic: Takehara) is no longer a valid reference under 35 U.S.C. §102(a) and the rejection is rendered moot to the extent that the priority document supports the claimed invention.

The JP priority document supports Claims 13 and 14 of the present application, but not the (P·V) values in Claims 15 and 16.

With respect to claims 15 and 16, Hiroaki (sic: Takehara) discloses a method for producing fullerenes using a combustion method, which employs fullerene-producing equipment comprising carbon-containing compound supply ports and oxygen-containing gas supply ports in multistage. Hiroaki (sic: Takehara), however, does not disclose the velocity of a combustion gas discharged from a discharge port, or that the elemental ratio of carbon in a hydrocarbon-

containing material gas with respect to oxygen in an oxygen-containing gas at the time of burning the hydrocarbon-containing material gas is controlled to 1.08 or higher but not higher than 1.56. Hiroaki (sic: Takehara), therefore, as a matter of fact, does not recite (V·P) values.

Claims 13 and 15-16 are rejected under 35 U.S.C. §102(b) as being anticipated by US 5,273,729 to Howard et al. With respect to Claim 13, the Examiner asserts Howard et al. (in addition to generally teaching flame synthesis of fullerenes, *see 3:24 et seq.*) recites the claimed velocity. Note that oxygen is added. As to claims 15-16, the Examiner asserts that pressures are taught that would meet the limitation, as noted in Table 1.

The present invention is an invention of improvement over the invention of Howard et al., which recites velocities of gas discharged from a burner including the highest velocity of 0.872 m/sec. On the other hand, in the present invention the velocity is remarkably increased to 2 m/s to 10 m/s. Moreover, in Howard et al., the elemental ratio of carbon in a carbon-containing compound with respect to oxygen in an oxygen-containing gas at the time of burning a hydrocarbon-containing compound (C/O ratio) is 0.72-1.07. In the present invention, the C/O ratio is enhanced to 1.08 or higher but not higher than 1.56, thereby increasing fullerene yield with respect to carbon in the carbon-containing compound to 0.5 % by mass or higher but not higher than 1% by mass. Note that in Howard et al., fullerene yield with respect to carbon in the carbon-containing compound is as low as 0.002-0.24 % by mass.

Furthermore, the present invention and Howard et al. are different in (V·P).

With respect to the claimed (V·P), Applicants note the following with respect to the Examples of Howard et al.:

Example	P (Torr)	V(m/s)	(V·P)
1a	20	0.503	10.06
1b	20	0.503	10.06
1c	20	0.503	10.06
2a	100	0.146	14.6
2b	100	0.146	14.6
3a	20	0.491	9.82
3b	20	0.491	9.82
4a	100	0.144	14.4
4b	100	0.144	14.4
5a	12	0.754	9.048
5b	12	0.754	9.048
6a	40	0.234	9.36
6b	40	0.234	9.36
7a	20	0.872	17.44
7b	20	0.872	17.44
7c	20	0.872	17.44
7d	20	0.872	17.44
7e	20	0.872	17.44

In Howard et al., calculation of data in the Table above suggests that the highest (V·P) is 17.44 m·torr, while in the present invention, (V·P) is 30m·torr or higher but not higher than 1000m·torr. For the above reason, Applicants submit that the feature of the present invention, i.e., "(V·P) in a range of 30 m·torr/s to 1000 m·torr/s" would not have been obvious over Howard et al. Therefore, Applicants specifically disagree with the rejection of claims 15 and 16.

Claim Rejections - 35 U.S.C. §103(a)

Claims 13-16 are rejected under 35 U.S.C. §103(a) as being unpatentable over US 5,273,729 to Howard et al.

Applicants respectfully disagree with the rejection for the same reason as the rejection with the rejection for anticipation as noted above.

Furthermore, Applicants note that Howard et al. teaches gas velocities in the range from 0.144 m/s to 0.872 m/s, which do not overlap 2 m/s – 10.0 m/s in the amended claim 1. The Examiner asserts that to the extent Howard et al. may not teach the claimed (V·P), Howard et al. teaches that "on an industrial scale, gas velocities could be much higher." The Examiner presumably infers that the (V·P) would then be much higher, possibly into the claimed range.

However, the above teaching of "gas velocities could be much higher" does not teach or suggest that the (V·P) would be in the claimed range. Applicants note that merely increasing the gas velocity would not render the (V·P) factor higher unless the P was held the same or increased as well. If the P were decreased, the (V·P) factor would not increase. Therefore, Applicants disagree with the rejection based on this point.

Claims 13-26 and 28 are rejected under 35 U.S.C. §103(a) as being unpatentable over US 2004/0057896 to Kronholm et al.

Claims 13-28 are rejected under 35 U.S.C. §103(a) as being unpatentable over 2004/0057896 to Kronholm et al. as applied to claim 12-26 and 28 above, and further in view of US 2003/0041732 to Alford. The Examiner asserts that to the extent Kronholm et al. may not

disclose whatever separation scheme Applicants are trying to claim, Applicants separation scheme is copied from Alford.

With respect to the Examiner's allegations of copying from Alford et al., Applicants agree that Figure 1 of the present invention closely resembles Fig. 2 of Alford et al. However, applicants disagree that this is evidence of copying of the invention of Alford et al., and further disagree that such similarity is evidence of obviousness over Alford et al. As noted above, Applicants have distinguished the present figures from the figures of Alford et al.

With respect to the rejections over Kronholm et al., and similar to as noted above, Applicants note that the cited Kronholm et al. was published on July 3, 2003. Therefore, Kronholm et al. would be a proper reference under 35 U.S.C. §102(a). However, as noted above, the present application claims priority to Japanese Application 2003-165384, filed on June 10, 2003, a verified translation of which is herein included. Therefore, Applicants rely on its priority date to antedate the reference with respect to claim 13.

Applicants note that Kronholm et al. does not describe the velocity of gas discharged from a burner, C/O ratio, etc. Also, in the invention of Kronholm et al., since soot is separated from a combustion gas discharged from a fullerene reactor by means of a solid/gas separator 230 located at the upper portion of the reactor thereof, fullerene in the end product has high purity. Kronholm et al., however, does not recite fullerene yield with respect to material, or yield of fullerene including all soot.

Consequently, Applicants submit that rejection of Claim 13 over Kronholm et al. should be withdrawn.

Applicants note that Kronholm et al. does not disclose (V·P) values recited in Claims 15 and 16, or cooling at a cooling rate of 1000 °C/s or higher recited in Claims 17 and 18.

Consequently, Applicants submit that rejection over Kronholm et al. should be withdrawn with respect to the above claim and claims dependent therefrom.

Claims 13-28 are rejected under 35 U.S.C. §103(a) as being unpatentable over US Howard et al. as applied to claims 13-16 above, and further in view of Alford et al. and JP 06-056414 to Katsuhide et al. The Examiner asserts that to the extent Howard et al. may not disclose the separation scheme as set forth in claims 17-22 and 24-28, Alford et al. does so.

As noted above, Applicants disagreed with the rejection of claims based on Howard et al.

With respect to Alford et al., Applicants note that the equipment of FIG. 1 of the present application resembles that of FIG. 2 of Alford et al. because in experiments to achieve the present invention, the present inventors used equipment including some parts purchased from a company associated with the applicant of Alford et al. and made various improvements to the equipment. The improvements include, for example, 1) inversion of the reactor, 2) replacement of the burner for changing combustion conditions, 3) replacement of the exhaust-gas cooler, and 4) increase in the ability of the vacuum pump. By making these improvements, the present inventors have achieved the method for producing fullerenes that permits remarkable increase in fullerene yield.

Alford et al. does not describe conditions under which fullerenes are produced using a fullerene furnace, let alone the features of the present invention. Therefore, Applicants submit that the reference fails to add to the insufficient rejections noted above.

With respect to Katsuhide et al., Applicants note that Katsuhide et al. describes a plasma generating furnace of inverted type having at a lower portion thereof a port for removing fullerenes produced. Katsuhide et al. discloses a method for production of fullerenes using plasma arc technology, and the method of Katsuhide et al. is different from that of the present invention that uses the combustion method for production of fullerenes. The furnace described in Katsuhide et al., which does not comprise a burner for burning carbon-containing fuel, does not generate combustion gas containing a large amount of soot, and thus is free from the problem of adhesion of soot in great quantity to side walls of the furnace. Moreover, Katsuhide et al. does not teach discharge of a hydrocarbon-containing material gas and an oxygen-containing gas into the furnace, and therefore, does not disclose the feature of the present invention, i.e., that "an average discharge velocity of a hydrocarbon-containing material gas and an oxygen-containing gas discharged from the discharge portion into the fullerene reactor is 2 m/s or higher but not higher than 10 m/s." For the above reasons, Applicants submit that the invention of Katsuhide et al. has no close relevance to the claims of the present application, and fails to add to the insufficient rejections noted above.

In conclusion, Applicants note that the present invention permits fullerene yield with respect to carbon in the carbon-containing compound to be increased to, e.g., 0.5% by mass or higher but not higher than 1% by mass, and the fullerene content in the soot-like material to be

increased to more than 7% by mass but not more than 50% by mass. (See the specification at paragraph [0029] and the JP priority document at paragraph [0011]) Moreover, the experimental data suggests increase of fullerene yield.

Consequently, Applicants submit that the present invention would not be reached by any combination of the cited documents.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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Enclosure: Certified Priority Document JP 2003-165384 with Verified English Translation